REMARKS

The present amendment is submitted in an earnest effort to advance this case to issue without delay.

1. The priority claim acknowledgment in paragraph 12 of PTOL-326 has not been filled out by the Examiner. Applicants would appreciate an acknowledgment of the claimed priority of Applicants German application of 3 June 2002 under the International Convention.

2. A substitute specification has been provided which includes the cross reference previously entered and some additional changes of a formal nature. The substitute specification does not contain any new matter. It is accompanied by a marked up version showing the changes made.

3. The claims have been amended to define the invention more sharply over the art. The claims are also in better form as amended.

4. The rejection of claim 3 under 35 USC 112, second paragraph is no longer applicable since the temperature limitations defining progressively narrower ranges have been placed in the new claims 8 and 9. There is only a single range in each of the claims 3, 8 and 9.

5. Claim 1 has been amended to exclude additional binder beyond the particulate place holder and the metal powder by the use of a "consisting essentially of ..." limitation in the second step. It also now defines the green body as having a compressive strength sufficient to allow machining of the green body, i.e. the body prior to sintering. Finally, the claim makes clear that the sintering is carried out in such manner as to maintain the open porosity.

Claim 2 has been cancelled as superfluous.

6. Claims 1 and 3 to 9 are deemed to be allowable over Vaidyanathan et al Patent 6,524,522 as taken with Bagley Patent 5,308,556.

Below, Applicants have provided their analysis of the references and have described how they believe that the invention distinguishes thereover. At this stage, Applicants merely note

that the references both require a binder in addition to the original claim 2 materials and in addition to the particular place holder. Not only are polymer binders not required for the invention, but the presence of polymer binders contributes to problems with respect to the green body.

The references do not provide, individually or in combination, a green body containing a place holder without a binder which has sufficient compressive strength as to enable it to be machined by conventional methods to impart shape to the structure which is maintained.

For that reason, Bagley cannot teach machining of the body of Vaidyanathan et al and Vaidyanathan cannot suggest modification of Bagley so that that reference would use green bodies limited as the claims now require. Claims 1 and 3 to 9 are therefore allowable over Vaidyanathan as taken with Bagley.

"The inventors do not agree with the communication of Daniel J. Jenkins suggestion by the Examiner that the invention is obvious. It is not obvious that the knowledge of US 6 524 522 (Vaidyanathan et al.) and US 5 308 556 (Bagley) is sufficient to produce highly porous net shape parts from ceramic and metals powders, which remain open porous after sintering. Especially in case of a high affinity of the powders to oxygen or carbon (e.g.

titanium) both inventions have a obvious drawback regarding the use of polymer binders, which are demanded in claim 1 in both cases.

US 6 524 522 describes a process, where a porous body is produced by an extrusion process using a binder system which contains two or more components. At least one component (A) is required to achieve a sufficient plasticity for the extrusion process. The plasticity is based on the fact that component (A) becomes liquid during the extrusion process. The melting point of component (A) is reported to be in the range of 125 – 250°C (col. 6, line 16 – 17). A second component (B) is added, which is immiscible in component (A). Preferentially, component (B) is also a polymer. Additionally, US 6 524 522 proposes the use of carbamide (urea) and ammonium hydrogen carbonate as pore forming agents. It is important to mention that Vaidyanathan introduce both materials as foaming agents (col. 4, line 18 – 19) and not as binders as written in the communication of Daniel J. Jenkins. It is well known from chemical literature (e.g. Rompp Chemie Lexikon) that both materials decompose completely in the temperature range, where component (A) becomes liquid. Therefore both materials are not suitable for the extrusion process as described in US 6 524 522. They start to decompose during the extrusion process causing the formation of uncontrolled porosity. Considering this, manufacturing

of parts with orientated porosity becomes impossible. The inventors seem to know about this behavior and do not give an example, where carbamide (urea) or ammonium hydrogen carbonate is used as pore forming component.

In the present application, carbamide (urea) or ammonium hydrogen carbonate are used as place holder materials for a powder technological process, where all pressing and shaping steps are done at room temperature. In this case, both materials act neither as a binder nor a foaming agent. The use of these materials as place holder for the powder technological manufacturing of porous metals or ceramics with well defined pore size, pore shape and porosity is already described in detail in the national patents DE 196 3,B 927 (filed 16 July 1998, carbamide) and DE 197 26 961 (filed 26 November 1998, ammonium hydrogen carbonate), which were filed earlier than US 6 524 522. The drawback of these patents is that it becomes only possible to manufacture parts with simple geometries like cylinders or plates, which tend to have closed pores on the surface. Closing of the pores is caused by the friction of metal powders on the die wall during ejection of the powder compact leading to a plastic deformation of the powder particles. This effect is well known in powder metallurgy (formation of a "pressing skin").

The invention of the present application is the development of a manufacturing route, where

- the shaping can be completely done at room temperature with conventional machining methods
- polymer binders are not required the place holder materials can be almost completely removed at temperatures which can be below 125˚C
- further debinding steps above 125˚C are not required
- the shape and the size of the pores as well as the porosity can be well adjusted by choosing the right particle size fraction and amount of the place holder material
- an open and interconnected porosity remains after sintering due to remove of the pressing skin during machining in the green state

It has been found that the materials now recited in claim 2 are preferentially suitable to fulfill all these demands. This behavior follows not inevitably from the already filed patents DE 196 38 927 and DE 197 26 961. Important to mention is the fact that additional binders are not required for green machining. Therefore, the method becomes especially suitable for the production of highly porous parts from materials showing a high affinity to carbon and oxygen (e.g. porous titanium)

US 5 308 556 describes a conventional way of machining powder compacts in the green state. From claim 1 it is obvious that a high molecular weight thermoplastic polymer is used to achieve a sufficient stability for green machining. This is a significant difference to PT 1.1993, where additional binders are not required."

Hence, for these reasons as well, claims 1 and 3 to 9 ought to be considered to be allowable and an early notice to that effect is earnestly solicited.

Respectfully submitted,
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